

Letter to the Editor[†]

Boiling and Splattering Liquid With the Er:YAG Laser

Doctor Hughes claims that he reproduced our experiments with our irradiation parameters [1]. This, however, is only true for the employed energy density (approximately 5 J/cm²) but not for the spot size (5 mm instead of 1.2 mm in our experiments). Therefore, total pulse energy is (5/1.2)²-fold, i.e., 17-fold, higher in his experiments. It was suggested by Dr. Hughes that scattering of infectious material and cells may have been produced by boiling the biological material rather than representing explosive dispersal in a laser plume. We find that it is impossible to heat up 1 cm³ of water or culture medium with an ER:YAG laser or with an CO₂ laser. Instead, the irradiation is absorbed in a surface layer with a thickness of approximately the absorption length. This layer is vaporized immediately while the temperature of adjacent water volume remains virtually unaltered. However, the evaporation results in a recoil effect, which is responsible for the observed splattering of water. This effect is of course much stronger under Dr. Hughes' experimental conditions.

With regard to the clinical relevance of our observations, laser plume contains gases, vapors, and dry particle as well as droplets. Due to the above-mentioned mechanisms, droplets are derived preferably from the borderline of the tissue interaction area and may contain unaltered vital

material. Thus, we believe that our cell layer model is of clinical relevance. Although not all constituents of laser plume are considered in our model, we believe, particularly with respect to contamination with infectious particles, that splattering of droplets plays an important role in clinical applications when the laser beam hits blood or other body liquids.

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REFERENCE

1. Ziegler BL, Thomas CA, Meier T, Müller R, Flidner TM, Weber L. Generation of infectious retrovirus aerosol through medical laser irradiation. *Lasers Surg Med* 1998; 22:37–41.

[†]This is a reply to Dr. Hughes' Letter to the Editor, which was published in LSM 23:248 (1998).